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ABSTRACT

The ongoing reform of mathematics instruction creates a need to refine students' assessment practices. This digest describes portfolios and provides information about the types, focus, and content of mathematics portfolios. The advantages and disadvantages of portfolio assessment are also discussed, and a list of World Wide Web resources related to portfolio assessment is provided. (Contains 13 references.) (ASK)

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The ongoing reform of mathematics instruction creates a need to refine student assessment practices. Columba & Dolgos (1995) claim that evaluating student computational skills by traditional methods cannot provide enough information related to the component of the overall evaluative process needed in mathematics. Current standardized tests seem like to measure performance on rote mathematical tasks instead of creating environments for students to reason, communicate, and problem solve.

In regard to measuring students' performance, NCTM (1989) states that "to demonstrate real growth in mathematical power, students need to demonstrate their ability to do major pieces of work that are more elaborate and time consuming than short exercises...portfolios are some examples of more instructional and assessment activities" (p.36) in *Assessment Standards for School Mathematics*. Like NCTM (1989), portfolio assessment is supported by many educators, because portfolio is considered as a collection of student work representing their mathematical power, a showcase for a student work or a place where many types of assignments, projects, reports, and writing can be collected (Columba & Dolgos, 1995). The idea of portfolio is close enough to satisfy educators' belief that assessment is most effective when it becomes an integral part of instruction.

The Types of the Portfolio Assessment

According to Columba & Dolgos (1995), there are basically three types of portfolios to consider for classroom use.

Showcase: This type of portfolio focuses on the student's best and most representative work. This type of portfolio is similar to an artist's portfolio where a variety of work is selected to reflect breadth of talent. Therefore, in this portfolio the student selects what he or she thinks is representative work. This folder is most often seen at open houses and parent visitations (Columba & Dolgos, 1995, p. 174-175).

Teacher-Student Portfolio: This type of portfolio is often called the "working portfolio" or a "working folder". This is an interactive teacher-student portfolio that aids in communication between teacher and student. The teacher and student conference to add or delete within the content of the portfolio (Columba & Dolgos, 1995, p. 175).

Teacher Alternative Assessment Portfolio: All the items in this type of portfolio are scored, rated, ranked, or evaluated. Teachers can keep individual student portfolios that are solely for the teacher's use as an assessment tool. This is a focused type of portfolio and is a model of the holistic approach to assessment (Columba & Dolgos, 1995, p. 175).

Focus and Content of Mathematics Portfolios

Some of the main goals of portfolios are to see "student thinking, student's growth over time, mathematical connections, student views of themselves as mathematicians, and the problem solving process" (Stenmark, 1991, p.37). A variety of items can be included in a mathematical portfolio in order to achieve these goals.

The Advantages of Portfolio Assessment

Because of the limitation of traditional assessment tests, many educators have been experimenting with alternative forms of assessment, and many have described the advantages of portfolio assessments. According to Owings and Follo(1992), the portfolio assessment can help students understand their strengths and weaknesses. They also believe that students are more able to link successes and failures to performance and may also facilitate goal setting through portfolio assessment. Gilman, Andrew and Rafferty (1995, p.22) and Midkiff and Thomasson (1993) have also identified several advantages of portfolios. According to them, portfolios can be used to evaluate both products and process, and they allow the integration of learning and assessment. Learning based on portfolio assessment can be more student-directed, and since evaluation is not based on single scores, instruction based on learning styles is more easily evaluated. Moreover, Gilman et al, (1995) claim that portfolios provide more information about student progress and encourage students to be responsible of their own learning. Therefore, students

Suggested Items to Consider for Mathematics Portfolios

- Open-ended questions.
- A report of group project.
- Work from another subject area .
- Problems posed by student.
- Art projects.
- A book review.
- Excerpts from a student's daily journal.
- A table of contents.
- Draft, revised, and final versions of student work on a complex mathematical problem.
- A description by the teacher of a student activity that displayed understanding of a mathematical concept.
- Newspaper and magazine articles.
- A letter from the student to the reader of the portfolio, explaining each item.
- Audio tapes of student-teacher interview.
- A photo or sketch made by student of student's work with manipulatives.
- Papers that show the student's correction of errors or misconceptions.
- Notes from an interview by the teacher or another student.
- Sample journal entries.
- Work in the student's primary language.
- Teacher-complicated checklists.
- Videotapes of student's work.
- A mathematical autobiography.
- Mathematical research.

SE061083

feel as they take bigger roles in the learning and the assessment processes. Portfolios also help students develop skills necessary for life-long learning. On the other hand, portfolios reduce the teacher's daily burden of grading papers. In sum, portfolios enable to assess global understanding and thinking skills with a multidimensional form of evaluation.

The Disadvantages of Portfolio Assessment

Even though results in using portfolio assessments are positive, some educators found disadvantages of using portfolios. In Koretz's (1994) study teachers indicated some concerns about the use of portfolios. Mostly they mentioned that portfolio assessment imposes substantial burdens on them such as time demands of planing and administering problems. Moreover, it is harder to ensure that portfolios are accurately recorded and scored students' performance; evaluation is more subjective than traditional testing, and reliability and validity can be questionable. Also, maintaining portfolios can be problematic and time-consuming. Finally, deciding the content of portfolios can be harder than other assessment techniques.

Conclusion

The findings of the research conducted by Wolfe (1996) show that "through the use of large-scale portfolio assessment, students can realize educational outcomes that are not afforded in an educational system that focuses on traditional goals such as acquiring content knowledge and performing well on standardized multiple-choice tests. Students...were able to reflect on and formulate statements about their personal beliefs and values, their understandings of themselves as learners and writers, their abilities and skills as writers, and their goals and aspirations" (p. 12). Moreover, the conclusion drawn from the National Conference on Linking Liberal Arts and Teacher Education (San Diego, California, October 6-7, 1994) was that portfolios are a valuable tool for demonstrating through authentic evidence that the professional skills necessary for teaching have been mastered, that many methods of portfolio use are valuable, and that further research in this area is necessary.

Agencies and Websites Having Information on Portforlio Assessment

National Council of Teachers of Mathematics (NCTM)
http://www.nctm.org
National Council on Measurement in Education (NCME)
http://assessment.iupui.edu/NCME/
National Center for Research on Evaluation, Standards, and Student Testing (CRESST)
http://cresst96.cse.ucla.edu/
ERIC Clearinghouse on Assessment and Evaluation (ERIC/TM)
http://ericae.net
Portfolio News (Portfolio Assessment Clearinghouse)
http://www-tep.ucsd.edu/portfolionews/PNHomePage.html
Eric Clearinghouse for Science, Mathematics and Environmental Education
http://www.ericse.org
Eisenhower National Clearinghouse for Mathematics and Science Education (ENC)
http://www.enc.org
Portfolio Resources
http://www-tep.ucsd.edu/portfolionews/PNResources.html

The portfolio assessment including open-ended questions can aid teachers in observing how students process mathematics information and also help differentiate the skill levels of individual students. However, the downside is that the use of portfolio assessment will require many teachers to face the difficult task of changing their teaching style. Great care must be used in proving the reliability, validity, and consistency of evaluating grades when using the portfolio assessment.

Resources

Asturias, H. (1994). Implementing the assessment standards for school mathematics: using students portfolios to assess mathematical understanding. *Mathematics Teacher*, 87(9), 698-701.

Brosnan, P. A. and Hartog, M. D. (1993). *Approaching standards for mathematics assessment.* (ERIC Document Reproduction Service No. ED 359 069)

Columba, L., and Dolgos, K. A. (1995). Portfolio assessment in mathematics. *Reading Improvement*, 32 (3), 174-176.

Gilman, D. A., Andrew, R. and Rafferty, C. D. (1995). Making assessment a meaningful part of instruction. *NASSP Bulletin*, 79 (573), 20-24.

Johnson, Judi Mathis (1994). Portfolio assessment in mathematics: Lessons from the field. *Computing Teacher*. v21 n6 p22-23.

Hayes, B. and Kretschmann, K. J. (1993). *Portfolio assessment: An annotated bibliography of selected resources.* (ERIC Document Reproduction Service No. ED 362 731)

Koretz, Daniel (1994). *The evolution of a portfolio program: The impact and quality of the Vermont Portfolio Program in its second year (1992-1993).* (ERIC Document Reproduction Service No. ED379301)

Midkiff, R. B. and Thomasson, R. D. (1993). *A practical approach to using learning styles in math instruction.* Springfield, IL: Thomas Books.

NCTM. (1995). *Assessment Standards For School Mathematics.* Reston, VA: Author.

Owings, C.A., and Follo,E.(1992). *Effect of portfolio assessment on students' attitudes and goal setting abilities in mathematics.* Michigan.

Stenmark, J. K. (1991). *Mathematics assessment: Myths, models, good questions and practical suggestions.* (ERIC Document Reproduction Service No. ED345943)

Smyser, S.(Ed.) *Encouraging reflection through portfolios. proceedings of the national conference on linking liberal arts and teacher education* (San Diego, California, October 6-7, 1994). (ERIC Document Reproduction Service No. ED390817)

Wolfe, Edward W (1996). *Student reflection in portfolio assessment.* (ERIC Document Reproduction Service No. ED396004)

Other Portfolio Information Available on the World Wide Web

Student Portfolios: Classroom Uses
http://www.ed.gov/pubs/OR/ConsumerGuides/classuse.html
Student Portfolios: Administrative Uses
http://www.ed.gov/pubs/OR/ConsumerGuides/admuses.html
Portfolio Assessment
http://www.eduplace.com/rdg/res/literacy/assess6.html

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